

### **REMARKS**

Claims 1, 4-5, 11-13, 16-17, 21-27, 30 and 41 are pending in this application. Claims 43-53 are newly added, and Claims 1, 11-13 and 30 are currently amended. It is respectfully submitted that such new claims and amendments are supported by the specification, drawings, abstract of the disclosure and claims, as originally filed and that no new matter has been added. Specifically, support for the amendments to claims 1 and 13 and for new claims 44-53 is found at least at paragraphs [0067] - [0070] and [0076] - [0078] and Tables 3, 4 and 6. Support for new claim 43 and amended claim 12 is found at least at paragraph [0033]. Support for amended claims 11 and 30 is found at least at paragraph [0032].

### ***REJECTIONS UNDER 35 U.S.C. 112***

Claims 11, 12 and 30 are rejected under 35 U.S.C. 112, first paragraph as failing to meet the enablement requirement. Claims 11, 12 and 30, as now amended, are enabled. As mentioned above, amended claim 12 is found at least at paragraph [0033], and support for amended claims 11 and 30 is found at least at paragraph [0032]. Moreover, the substrate recited at amended claims 11, 12 and 30 comprises the elements of their respective base claims, and ***further comprise*** the features specifically recited therein. Thus, the substrates of claims 11 and 30 comprise each of a monocrystalline silicon-containing material and a substantially amorphous silicon-containing material, while the substrate of claim 12 comprises each of a monocrystalline silicon-containing material and a porous silicon-containing material. The rejection is thus overcome.

### ***REJECTIONS UNDER 35 U.S.C. 102***

Claims 1, 4-5, 11, 41 and 13, 16, 17, 21, 25-27 and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. patent no. 5,429,708 to Lindford et al. (hereinafter "Lindford et al."). Each of claims 1, 4-5, 11, 41 and 13, 16, 17, 21, 25-27 and 30, as now amended, is allowable for the reasons that follow.

In order to anticipate a claim under 35 U.S.C 102, a reference must disclose each and every element of the claim and must enable those skilled in the art to make or use the invention without undue experimentation. Lindford et al. neither disclose each and every element of Applicant's invention as set forth at any of claims 1, 4-5, 11, 41 and 13, 16, 17, 21, 25-27 and 30, as now amended, nor do Lindford et al. enable those skilled in the art to make or use the invention.

First, Lindford et al. do not disclose all of the features of any of amended claims 1, 4-5, 11, 41 and 13, 16, 17, 21, 25-27 and 30. Specifically, claim 1, as now amended, recites a semiconductor substrate comprising a monocrystalline silicon-containing material and an organic layer chemically bonded to the surface of the silicon-containing material. As a result of the chemical bonding of the organic layer to the surface, the surface comprises a measurable carrier lifetime for low-level injection of more than approximately 7.8  $\mu$ s or for high-level injection of more than approximately 12  $\mu$ s, or a measurable surface recombination velocity of less than approximately 1300 cm/s for low-level injection or less than approximately 810 cm/s for high-level injection. This advantageous feature is not disclosed anywhere by Lindford et al. Moreover, the advantageously high carrier lifetimes and surface recombination velocities of the semiconductor substrate recited at amended claim 1 provide vast industrial, scientific, and commercial applicability and advantage.

Second, Lindford et al. does not provide sufficient description to enable one skilled in the art to make or use, without undue experimentation, a semiconductor substrate comprising a monocrystalline silicon-containing material having a surface substantially free of oxidation, and an organic layer having more than half of its atoms being carbon and hydrogen and exhibiting any improvement of one or more of the recited properties as compared to the electrical property of the substrate in the absence of the organic layer, and particularly not those advantageous values set forth at Applicant's amended claims. The experimental procedures set forth in detail at Applicant's specification and the experimentally-measured values provide such enablement for the currently amended claims.

Finally, the Examiner concedes that Lindford et al. has not disclosed any quantitative values for any of the properties, and particularly neither carrier lifetimes nor surface

recombination velocities, but maintains that such improvements are inherent in Lindford's devices and processes. Lindford et al. do not disclose whether any electrical property was in fact measured at all. It is respectfully submitted that those skilled in the art understand that without measuring an electrical property of a research sample, then there is no way of knowing whether that property has been improved by the experimental procedure, at all, and particularly not the advantageous values for measurable carrier lifetimes and surface recombination velocities recited at Applicant's claim 1.

Claims 4-5, 11 and 41 are allowable as being dependent upon amended base claim 1. Claim 13, as now amended, is allowable for the same reasons as amended claim 1. Claims 16, 17, 21, 25-27 and 30 are allowable as being dependent upon amended base claim 13.

### ***REJECTIONS UNDER 35 U.S.C. 103***

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lindford et al. in view of U.S. patent no. 3,961,353 to Aboaf et al. Claim 12, as now amended, is allowable as being based upon amended base claim 1 for the reasons set forth above.

Claims 13 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese patent application no. JP 6-84853 A to Tsukune et al. (hereinafter "Tsukune et al.") in view of Wolf et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, Lattice Press: Sunset Beach, CA, 1986, p. 5 (hereinafter "Wolf et al."). Claims 13, as now amended, is allowable for the reasons that follow. Neither Tsukune et al. nor Wolf et al. nor any combination thereof teaches or suggests all of the features of amended claim 13. Specifically, claim 13, as now amended, recites a process for forming a semiconductor substrate, comprising providing a monocrystalline silicon-containing material and forming an organic layer thereon that is chemically bonded to the surface of the silicon-containing material. As a result of the chemical bonding of the organic layer to the surface, the surface comprises a measurable carrier lifetime for low-level injection of more than approximately 7.8  $\mu$ s or for high-level injection of more than approximately 12  $\mu$ s, or a measurable surface recombination velocity of less than approximately 1300 cm/s for low-level injection or less than approximately 810 cm/s for high-level injection.

This feature is not taught or suggested anywhere by Tsukune et al. nor Wolf et al. nor any combination thereof. Moreover, the advantageously high carrier lifetimes and surface recombination velocities of the semiconductor substrate produced by the process recited at amended claim 13 provide vast industrial, scientific, and commercial applicability and advantage. Claims 21-24 are allowable as being dependent upon amended base claim 13.

*Newly Added Claims*

Claim 43 is allowable as being dependent upon amended base claim 13, and for the same reasons as amended claim 12.

Claims 44-48 are allowable as depending from amended claim 1. Claims 49-53 are allowable as depending from amended claim 13.

Claim 44 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a silicon substrate including an organic layer chemically bonded to the surface of the silicon-containing material, wherein the surface comprises a methylated surface with measurable carrier lifetimes for low-level injection of at least approximately 260  $\mu$ s or for high-level injection of at least approximately 290  $\mu$ s, or with measurable surface recombination velocities of not more than approximately 17 cm/s for low-level injection or 21 cm/s for high-level injection, or combinations thereof. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 45 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a silicon substrate including an organic layer chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an ethylated surface with measurable carrier lifetimes of more than approximately 40  $\mu$ s, or with measurable surface recombination velocities of less than approximately 350 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 46 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a silicon substrate including an organic layer chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an ethylated surface with measurable carrier lifetimes of more than approximately 30  $\mu$ s, or with measurable surface recombination velocities of less than approximately 470 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 47 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a silicon substrate including an organic layer chemically bonded to the surface of the silicon-containing material, wherein the surface comprises a hexylated, octylated or dodecylated surface with measurable carrier lifetimes of at least approximately 20  $\mu$ s, or with measurable surface recombination velocities of not more than approximately 200 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 48 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a silicon substrate including an organic layer chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an alkoxyated surface with measurable carrier lifetimes of more than approximately 150  $\mu$ s for low-level injection or more than approximately 140  $\mu$ s for high-level injection, or with measurable surface recombination velocities of not more than approximately 70 cm/s, or combinations thereof. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 49 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a process for forming a semiconductor substrate including a monocrystalline silicon-containing material having a surface substantially free of oxidation and including an organic layer thereon having more than half of its atoms being carbon and hydrogen, wherein the organic layer is chemically bonded to the surface of the silicon-containing material, wherein the surface comprises a methylated surface with measurable carrier lifetimes for low-level injection of at least approximately 260  $\mu$ s or for high-level injection of at least

approximately 290  $\mu$ s, or with measurable surface recombination velocities of not more than approximately 17 cm/s for low-level injection or 21 cm/s for high-level injection, or combinations thereof. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 50 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a process for forming a semiconductor substrate including a monocrystalline silicon-containing material having a surface substantially free of oxidation and including an organic layer thereon having more than half of its atoms being carbon and hydrogen, wherein the organic layer is chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an ethylated surface with measurable carrier lifetimes of more than approximately 40  $\mu$ s, or with measurable surface recombination velocities of less than approximately 350 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 51 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a process for forming a semiconductor substrate including a monocrystalline silicon-containing material having a surface substantially free of oxidation and including an organic layer thereon having more than half of its atoms being carbon and hydrogen, wherein the organic layer is chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an ethylated surface with measurable carrier lifetimes of more than approximately 30  $\mu$ s, or with measurable surface recombination velocities of less than approximately 470 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 52 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a process for forming a semiconductor substrate including a monocrystalline silicon-containing material having a surface substantially free of oxidation and including an organic layer thereon having more than half of its atoms being carbon and hydrogen, wherein the organic layer is chemically bonded to the surface of the silicon-containing

material, wherein the surface comprises a hexylated, octylated or dodecylated surface with measurable carrier lifetimes of at least approximately 20  $\mu$ s, or with measurable surface recombination velocities of not more than approximately 200 cm/s, or both. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

Claim 53 is further allowable because none of the references being relied upon by the Examiner teaches or suggests a process for forming a semiconductor substrate including a monocrystalline silicon-containing material having a surface substantially free of oxidation and including an organic layer thereon having more than half of its atoms being carbon and hydrogen, wherein the organic layer is chemically bonded to the surface of the silicon-containing material, wherein the surface comprises an alkoxylated surface with measurable carrier lifetimes of more than approximately 150  $\mu$ s for low-level injection or more than approximately 140  $\mu$ s for high-level injection, or with measurable surface recombination velocities of not more than approximately 70 cm/s, or combinations thereof. Moreover, such advantageous measurable carrier lifetimes and/or surface recombination velocities are clearly not enabled by any description in any of these references.

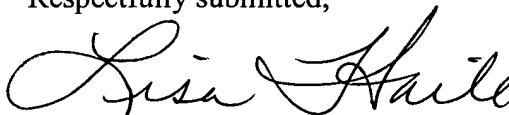
For the reasons set forth above, it is respectfully submitted that the application is now in condition for allowance. The Examiner's reconsideration and further examination are respectfully requested.

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A check in the amount of \$610.00 is enclosed for the \$395.00 RCE filing fee and the \$215.00 Two Month Extension of Time fee, for a total of \$610.00. If any other fees that may be associated with this submission are due, or credit any overpayment, please charge Deposit Account No. 50-1355.

Respectfully submitted,



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Lisa A. Haile, J.D., Ph.D.

Reg. No. 38,347

Telephone No.: (858) 677-1456

Facsimile No.: (858) 677-1465

GRAY CARY WARE & FREIDENRICH LLP  
4365 Executive Drive, Suite 1100  
San Diego, California 92121-2133  
**USPTO CUSTOMER NUMBER 28213**